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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification <sup>6</sup> : <b>G07F 19/00, G06F 17/60</b></p>	<p><b>A2</b></p>	<p>(11) International Publication Number: <b>WO 99/49431</b></p> <p>(43) International Publication Date: 30 September 1999 (30.09.99)</p>
<p>(21) International Application Number: PCT/GB99/00927</p> <p>(22) International Filing Date: 24 March 1999 (24.03.99)</p> <p>(30) Priority Data: 9806843.0 24 March 1998 (24.03.98) GB</p> <p>(71) Applicant (for all designated States except US): KORALA ASSOCIATES LIMITED [GB/GB]; John Cotton Building, Sunnyside, Edinburgh EH7 5RA (GB).</p> <p>(72) Inventor; and</p> <p>(75) Inventor/Applicant (for US only): KORALA, Aravinda [FR/GB]; KAL, John Cotton Building, Sunnyside, Edinburgh EH7 5RA (GB).</p> <p>(74) Agent: KENNEDY &amp; CO.; Station House, 34 St. Enoch Square, Glasgow G1 4DF (GB).</p>		<p>(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW. ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> Without international search report and to be republished upon receipt of that report.</p>
<p>(54) Title: APPARATUS AND METHOD FOR PROVIDING TRANSACTION SERVICES</p> <div data-bbox="370 1161 1166 1570" data-label="Diagram"> <pre> graph TD     1[Server] --- 2[ATM]     1 --- 3[ATM]     1 --- 4((ATM))     1 --- 5((ATM)) </pre> </div> <p>(57) Abstract</p> <p>Apparatus and method for providing transaction services, in particular a computer-based transaction machine, such as an ATM, and a method for providing transaction services using said transaction machine. One or more software applications interact with middleware software through functional interfaces that are hardware independent but provide functionality which is implemented in a manner adapted to the capabilities of the particular hardware implementation. Objects provided for standard transaction functions are independent of the interface between the user and the transaction machine, said interface being customisable. The resulting transaction machines are typically combined into networks and these networks may readily be combined to form an Extranet.</p>		

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1 APPARATUS AND METHOD FOR PROVIDING TRANSACTION SERVICES.

2

3 The present invention relates to apparatus and a method  
4 for providing transaction services. In particular it  
5 relates to networked computer-based transaction machines  
6 and a method for providing transaction services using  
7 said transaction machines.

8

9 Transaction machines are herein defined as any computer-  
10 based machine able to interact with a user.

11

12 The term ATM is used herein to refer to any transaction  
13 machine able to dispense cash. Typically, such machines  
14 can also undertake physical transactions such as  
15 inputting information through a keypad or touch screen,  
16 making sounds, producing video and printing. They might  
17 also be able to read bank cards and such like. Kiosks  
18 are transaction machines unable to dispense cash, but  
19 otherwise able to provide a range of interactive  
20 features, often relating to financial services. For test  
21 purposes, a conventional PC may be used as a transaction  
22 machine.

1

2 Electronic cash machines are a large and rapidly growing  
3 market. Many different hardware providers produce  
4 equipment for this market such as the machines  
5 themselves, the servers to which they connect and the  
6 networking means through which they typically  
7 communicate. Furthermore, many different operating  
8 systems and applications are used both for operating and  
9 developing these systems.

10

11 As a result of the complexity and diversity of hardware  
12 and software currently being used in this field, it is  
13 difficult and expensive to alter these systems to extend  
14 their functionality, upgrade to newer and better  
15 hardware, software or networking means or to interface  
16 with other systems. As it is difficult to make even  
17 small changes to complex systems without running the risk  
18 of their malfunctioning, the evolution of such systems is  
19 slow.

20

21 It would therefore be advantageous to find a way of  
22 making it easier to alter the hardware, software and  
23 network components of ATMs/kiosks, their servers and  
24 their networking means.

25

26 Furthermore, it would be advantageous to provide a means  
27 for enabling such changes to be implemented in small  
28 stages.

29

30 Yet further, it would be advantageous to find a way to  
31 reduce the risk of such systems malfunctioning.

32

1 In current practice, it is difficult and therefore  
2 expensive to operate ATM/kiosk networks containing  
3 diverse hardware, software and networking means. Often  
4 large amounts of hardware and software must be upgraded  
5 concomitantly to reduce interface problems. Furthermore,  
6 it is difficult to interface networks of dissimilar  
7 devices, perhaps belonging to different organisations.  
8 If dissimilar ATM/kiosk systems could be readily  
9 interfaced, forming a so-called Extranet, new and useful  
10 co-operative applications could be developed which,  
11 although currently possible, are prohibitively complex  
12 and expensive at the present time.

13  
14 It would therefore be advantageous to provide a better  
15 means of networking ATMs/kiosks which use diverse  
16 hardware, software and networking implementations. In  
17 particular, it would be advantageous to provide a means  
18 of allowing co-operation between dissimilar networks.  
19 Furthermore, it would be advantageous to reduce the  
20 amount of work required to enable ATM/kiosk applications  
21 to run on dissimilar hardware implementations.

22  
23 At the present time, there is a rapid growth in  
24 electronic commerce (e-commerce), usually conducted over  
25 the internet. E-commerce is being limited by  
26 difficulties gaining access to the internet for many  
27 consumers and due to the limitations of the machines  
28 currently used by consumers for internet transactions. A  
29 typical e-commerce consumer will access a web site using  
30 a home PC. However, home PCs lack facilities such as the  
31 ability to dispense cash or read a smartcard which are  
32 important in many types of common financial transaction.

1

2 It would therefore be desirable to provide a means of  
3 allowing internet-based e-commerce to be accessed from  
4 ATMs and kiosks which already have hardware facilities  
5 suitable for financial transactions. This would allow e-  
6 commerce services to be provided which required expensive  
7 or high-security hardware facilities which cannot be  
8 securely provided at a reasonable cost on privately owned  
9 web browsers. Furthermore, it would be possible for e-  
10 commerce to be made readily available to a much larger  
11 base of consumers than is currently available.

12

13 The design of ATM networks typically involves input from  
14 numerous professionals such as software and hardware  
15 engineers specialising in the various systems,  
16 applications and communications means, graphics and GUI  
17 specialists, language specialists and so forth. In  
18 current working practice these specialists are highly  
19 dependent on each other and much time and money is spent  
20 communicating different requirements amongst people  
21 working on diverse areas of a project.

22

23 It would therefore be advantageous to provide a means by  
24 which the different specialists working on a project may  
25 work more independently. In particular, it would be  
26 highly advantageous to provide a means by which the  
27 different specialists may customise elements of the  
28 application pertaining to their own specialisation  
29 without affecting other elements of the application. It  
30 would be particularly advantageous if the different  
31 specialists were able to use well known prior art  
32 authoring tools to prepare aspects of the application.

1 According to the present invention there is provided a  
2 method for providing transaction services wherein

3

4 (a) the user of the transaction services interacts  
5 with a computer-based transaction machine which is  
6 controlled by one or more software applications;

7

8 (b) the software applications interact with the  
9 functional interfaces of middleware software, which  
10 extends the functionality of an underlying operating  
11 system; and

12

13 (c) said functional interfaces provide functionality  
14 which is implemented in a manner adapted to the  
15 particular hardware capabilities of the transaction  
16 machine.

17

18 The computer-based transaction machine may be selected  
19 from a group which comprises automatic teller machines,  
20 kiosks, electronic point of sale machines and the like.

21

22 Preferably, the middleware software comprises a series of  
23 transaction objects and controls for standard device  
24 functions.

25

26 More preferably, transaction objects are independent of  
27 the interface between the user and the transaction  
28 machine; the interface between the user and the  
29 transaction machine being customisable.

30

31 Preferably, the controls implement a capabilities  
32 interface.



1

2 More preferably, the capabilities interface is able to  
3 communicate the capabilities of the control software.

4

5 The applications, objects and controls may be fully  
6 concurrent and asynchronous.

7

8 The controls may have a mode in which events are queued  
9 up and delivered to the application on demand.

10

11 Preferably, controls can run on the transaction machine  
12 even when supported hardware devices are not present.

13

14 More preferably, the middleware software uses one or more  
15 open standards for interacting with different hardware  
16 systems.

17

18 Preferably, the middleware software only provides  
19 cancellation commands for functions which can be  
20 successfully cancelled.

21

22 The middleware software may only requires a timeout  
23 command to be supplied when it is meaningful to do so.

24

25 Preferably, all controls are persistent.

26

27 More preferably, there is provided a control containing a  
28 persistent object.

29

30 Preferably, all errors and transgressions are asserted by  
31 the middleware software.

32

1 Preferably, the middleware software provides a trace  
2 facility that is always enabled and which logs trace  
3 events.

4  
5 The middleware software may use a ring buffer to store a  
6 log of trace events.

7  
8 Preferably, the middleware software writes trace data to  
9 memory and then copies it to disk only when the  
10 transaction machine is idle.

11  
12 Preferably, one or more software applications are hosted  
13 in a web browser.

14  
15 More preferably, the use of a web browser provides  
16 support for software distribution and network  
17 connections.

18  
19 An additional browser frame may be provided which  
20 contains the device controls required to detect events  
21 which must be dealt with immediately they occur.

22  
23 The middleware software may comprise a series of COM  
24 components with a scriptable ActiveX\* interface.

25  
26 The middleware software may comprise a series of  
27 Javabeans™ components with a scriptable interface.

28  
29 The use of a web browser may allow conventional web sites  
30 to be displayed by the computer-based transaction  
31 machine.

32

1 Preferably, the middleware software allows or disallows  
2 access to particular web sites according to a rule  
3 database.

4  
5 The middleware software may be adapted to customise time-  
6 out of the display of individual internet web sites.

7  
8 Preferably, said computer-based transaction machine is  
9 adapted to allow the software applications and middleware  
10 to be altered across a network by an authority.

11  
12 More preferably, the transaction machine communicates  
13 information about its status to a remote monitoring  
14 station across a network.

15  
16 According to a second aspect of the present invention,  
17 there is provided a computer-based transaction machine;  
18 wherein said computer-based transaction machine is  
19 provided with hardware devices for interaction with users  
20 and the exchange of transaction-related information with  
21 other machines; wherein said computer-based transaction  
22 machine is controlled by one or more software  
23 applications; wherein said software applications control  
24 hardware devices through functional interfaces with  
25 middleware software; wherein said middleware software  
26 extends the functionality of an underlying operating  
27 system and wherein said functional interfaces are  
28 hardware independent but provide functionality which is  
29 implemented in a manner adapted to the capabilities of  
30 the particular hardware devices which are provided.

31

1 The computer-based transaction machine may be selected  
2 from a group which comprises automatic teller machines,  
3 kiosks, electronic point of sale machines and the like.

4

5 Preferably, the middleware software comprises a series of  
6 transaction objects and controls for standard device  
7 functions.

8

9 More preferably, transaction objects are independent of  
10 the interface between the user and the transaction  
11 machine; the interface between the user and the  
12 transaction machine being customisable.

13

14 Preferably, the controls implement a capabilities  
15 interface.

16

17 More preferably, the capabilities interface is able to  
18 communicate the capabilities of the control software.

19

20 The applications, objects and controls may be fully  
21 concurrent and asynchronous.

22

23 The controls may have a mode in which events are queued  
24 up and delivered to the application on demand.

25

26 Preferably, controls can run on a transaction machine  
27 even when supported hardware devices are not present.

28

29 More preferably, the middleware software uses one or more  
30 open standards for interacting with different hardware  
31 systems.

32

1 Preferably, the middleware software only provides  
2 cancellation commands for functions which can be  
3 successfully cancelled.

4  
5 The middleware software may only requires a timeout  
6 command to be supplied when it is meaningful to do so.

7  
8 Preferably, all controls are persistent.

9  
10 More preferably, there is provided a control containing a  
11 persistent object.

12  
13 Preferably, all errors and transgressions are asserted by  
14 the middleware software.

15  
16 Preferably, the middleware software provides a trace  
17 facility that is always enabled and which logs trace  
18 events.

19  
20 The middleware software may use a ring buffer to store a  
21 log of trace events.

22  
23 Preferably, the middleware software writes trace data to  
24 memory and then copies it to disk only when the  
25 transaction machine is idle.

26  
27 Preferably, one or more software applications are hosted  
28 in a web browser.

29  
30 More preferably, the use of a web browser provides  
31 support for software distribution and network  
32 connections.

1

2 An additional browser frame may be provided which  
3 contains the device controls required to detect events  
4 which must be dealt with immediately they occur.

5

6 The middleware software may comprise a series of COM  
7 components with a scriptable ActiveX<sup>®</sup> interface.

8

9 The middleware software may comprise a series of  
10 Javabeans<sup>™</sup> components with a scriptable interface.

11

12 The use of a web browser may allow conventional web sites  
13 to be displayed by the computer-based transaction  
14 machine.

15

16 Preferably, the middleware software allows or disallows  
17 access to particular web sites according to a rule  
18 database.

19

20 The middleware software may be adapted to customise time-  
21 out of the display of individual internet web sites.

22

23 Preferably, the computer-based transaction machine is  
24 adapted to allow the software applications and middleware  
25 to be altered across a network by an authority.

26

27 More preferably, the transaction machine can communicate  
28 information about their status to a remote monitoring  
29 station across a network.

30

31 According to a third aspect of the present invention  
32 there is provided a network comprising a plurality of

1 computer-based transaction machines, one or more  
2 networking means and one or more application servers.

3

4 According to a fourth aspect of the present invention,  
5 there is provided an Extranet formed by combining a  
6 plurality of networks of computer-based transaction  
7 machines.

8

9 Preferably, the Extranet is provided with a security  
10 mechanism which limits the hardware functionality  
11 available to individual software applications.

1 An example embodiment of the present invention, referred  
2 to as the system, will now be described with reference to  
3 the following Figures wherein:

4

5 Figure 1 shows a simple ATM network;

6 Figure 2 shows an ATM network with diverse hardware;

7 Figure 3 shows two distinct networks being combined

8 to form an Extranet; and

9 Figure 4 shows the software architecture of the  
10 preferred implementation of the system.

11

12 Figure 1 shows a simple ATM network comprising a server  
13 1, a networking means 2 and an ATM 3. The system is  
14 designed to operate such networks and also more complex  
15 networks such as shown in Figure 2 wherein there may be  
16 ATMs of different functionality, here labelled 4.

17

18 A particular benefit of the system is its ability to  
19 allow distinct networks to operate together as shown in  
20 Figure 3. Here, two distinct networks 5 and 6 operated  
21 by distinct servers 7 and 8 are connected 9. The  
22 resulting joined network is referred to as an Extranet.

23

24 By joining multiple networks together, it becomes  
25 possible for different organisations to co-operate in the  
26 provision of ATM/kiosk network services. For example,  
27 suppose that a bank which owned a series of conventional  
28 ATMs and an airline which owned a series of ticketing  
29 kiosks chose to co-operate. There exists the potential  
30 for the bank's ATMs to both allow customers to pay for an  
31 airline ticket and to print out that ticket. Similarly,  
32 the airline might offer a limited selection of banking



1 services, such as balance display, which are compatible  
2 with the functionality of their kiosks.

3

4 Using prior art, the development of such a system would  
5 be complex, particularly due to the different hardware  
6 and capabilities of the bank's ATMs and the airline's  
7 kiosks. Such co-operation between organisations is by no  
8 means impossible at the present time, but is currently  
9 rare due to the complexity and expense required for  
10 implementation.

11

12 In general, the system provides a means for a plurality  
13 of servers to operate a plurality of ATMs and kiosks  
14 using a plurality of networking means. An example  
15 application would be to allow consumers to purchase eg  
16 cinema, theatre and airline tickets from different  
17 organisations through ATMs positioned at convenient  
18 locations.

19

20 Typically, the networking means will be the internet, a  
21 corporate intranet or LAN but may be any networking means  
22 or a mixture of networking means.

23

24 The system comprises a middleware software layer which  
25 extends the function of an underlying operating system  
26 and which in turn provides a single programming interface  
27 for an ATM/kiosk control application to be written to.

28

29 Figure 4 shows the software architecture of the preferred  
30 implementation of the system. An ATM/kiosk control  
31 application 10 is hosted in a web browser 11 such as  
32 Microsoft's Internet Explorer. The application runs on a

1 computer with a particular operating system, 12, such as  
2 Windows NT\*, the functionality of which has been extended  
3 by middleware software 13.

4  
5 The middleware comprises a series of components and  
6 objects, for use by the application, which extend the  
7 functionality of the operating system and provide tools  
8 to simplify development of the ATM application.

9  
10 In the preferred implementation all of the system's sub-  
11 systems are implemented as a series of COM components  
12 with an ActiveX\* interface or as Javabeans™ with a  
13 scriptable interface. This architecture enables  
14 applications running within Internet Explorer to access  
15 functionality provided by the operating system and the  
16 middleware, including access to hardware.

17  
18 A useful benefit of this implementation is that  
19 applications may be prepared using common authoring tools  
20 and such as Microsoft\*'s FrontPage\*, VisualStudio\*, Visual  
21 Interdev\* and common development environments such as  
22 Visual Basic\*, Visual C++\*, Powerbuilder\*, Delphi\* etc.  
23 This means that applications can be prepared with tools  
24 with which developers will be familiar and which, due to  
25 their popularity, provide facilities and support that  
26 would be prohibitively expensive to prepare for a custom  
27 development environment.

28  
29 A further benefit of using browser technology is that  
30 they provide an environment in which software download  
31 can be readily controlled. The application may be held  
32 entirely locally to an ATM/kiosk, entirely on a server or

1 any compromise between these two extremes. The  
2 application can be downloaded daily if required.

3

4 The system uses the Windows<sup>®</sup> Open System Architecture  
5 Extensions for Financial Services (WOSA XFS) to support  
6 ATM hardware in a vendor independent manner.

7

8 The system also uses the Object Linking and Embedding for  
9 Point Of Sale (OPOS) standard for interacting with  
10 different hardware systems. This means that applications  
11 can access hardware independent of whether the underlying  
12 hardware supports WOSA XFS or OPOS.

13

14 The system also supports the PC/SC standard for  
15 smartcards, thereby providing a uniform way of accessing  
16 smartcards.

17

18 Furthermore, the system also provides support for a  
19 variety of other open standards such as OFX and SNMP and  
20 transaction monitors such as NCR's TOPEND<sup>®</sup>.

21

22 Clearly, support for additional standards may readily be  
23 added.

24

25 The primary subsystems of the middleware software  
26 comprise a series of wizards, device controls, self-  
27 service controls, communications controls and status  
28 monitoring components.

29

30 The top level components are the wizards, which are a  
31 series of transaction objects that implement common  
32 ATM/kiosk transactions such as dispensing cash, printing

1 a statement etc. In the preferred embodiment, each is  
2 implemented as an ActiveX<sup>®</sup> object or a Javabeans<sup>™</sup>. Whilst  
3 wizards are running, they take control of the function of  
4 the ATM/kiosk. Wizards interface with other controls and  
5 encode all of the top-level control logic.

6  
7 Applications can be built with the system by customising  
8 and combining wizards. Wizards encapsulate all of the  
9 features and functionality required by a particular  
10 transaction or chunk of application. When using ActiveX<sup>®</sup>.  
11 Wizards receive input via ActiveX<sup>®</sup> properties and methods  
12 and output their state as a set of ActiveX<sup>®</sup> events.  
13 Alternatively the wizard can be implemented in the same  
14 way as a Javabeans<sup>™</sup>. As a result of this design feature,  
15 the wizard is completely independent of the ATM/kiosk-  
16 user interface.

17  
18 For example, an ATM might have a single button which  
19 dispenses \$10 on demand. A second ATM might implement  
20 more complex controls and display a detailed animation  
21 whilst money is issued. However, the same wizard may be  
22 used to implement both these ATMs. The wizard  
23 encapsulates the essential software logic of the  
24 transaction while allowing the user interface to be  
25 freely defined by script on the browser page.

26  
27 This has several important benefits which will lead to  
28 time and cost savings: firstly, the encapsulated features  
29 within the wizard can be reused between different  
30 applications whilst allowing the different applications  
31 to have totally different look and feel. Secondly, this  
32 allows the user interface to be designed with common web

1 tools. Thirdly, the user interface may be designed  
2 without any risk of compromising the function of the  
3 wizard. Finally, the user interface may be designed by a  
4 specialist who may not be an expert in the other aspects  
5 of ATM/kiosk software and hardware.

6  
7 An additional important feature of the wizards is that  
8 they are able to interpret the capabilities of the  
9 hardware on which they are run. For example, they may be  
10 able to establish whether a cash dispensing means is  
11 available. One application may then run on a plurality  
12 of different hardware implementations, adapting its  
13 functionality to the capabilities of that hardware.

14  
15 This not only allows different hardware implementations  
16 to be incorporated into the same network but allows  
17 distinct networks to be joined into an Extranet.

18  
19 The device controls provide hardware independent access  
20 to the special devices on an ATM or kiosk. Each device  
21 control acts as a persistent server that can be  
22 controlled and interrogated by one or more applications  
23 or wizards. A device control abstracts the details of  
24 the hardware underneath it and acts as a complete server  
25 for that device. Applications and wizards interact with  
26 controls through a scriptable ActiveX<sup>®</sup> interface or a  
27 Javabeans<sup>™</sup> interface.

28  
29 Some example device controls supported by the system are:

- 30 • Camera  
31 • Card Reader (motorized, swipe, DIP, smart cards etc.)

- 1 • Cash Acceptor
- 2 • Cash Dispenser
- 3 • Coin Dispenser
- 4 • Depository
- 5 • Doors
- 6 • Encryptor
- 7 • Guide Lights
- 8 • Indicators
- 9 • Journal Printer
- 10 • Keyboards
- 11 • Laser Printers
- 12 • Modems
- 13 • Operator Panel
- 14 • Passbook (including page turn)
- 15 • Pin Pad
- 16 • Receipt Printer
- 17 • Scanner
- 18 • Sensors
- 19 • Signature Capture
- 20 • Statement Printer
- 21 • Touchscreen
- 22 • UPS
- 23 • VendorMode
- 24 • Weighing Scales

25

26 Multiple applications may be run simultaneously and  
27 device controls are fully concurrent. This is important  
28 as the cycle time of ATMs and kiosk transactions can be  
29 critical. Their design is such that they can be used in  
30 an event-driven manner, with controls reporting their

1 result (success or failure) via ActiveX<sup>®</sup> or Javabeans<sup>™</sup>  
2 events, or in a procedural manner from within a language  
3 such as C++. In the event-driven mode, applications can  
4 be readily created using browser technology; for example,  
5 readily available web tools which provide appropriate  
6 easy-to-use graphical interfaces can be used to create  
7 event-driven applications.

8

9 In order to be able to operate asynchronously, all  
10 controls create their own thread, called the event  
11 thread, when first constructed. When an asynchronous  
12 method is called, a command message is sent to the event  
13 thread. The event thread carries out the command and  
14 sends a message back to the main thread on completion:  
15 the completion method causes the appropriate event to be  
16 fired. By implementing commands using the event thread,  
17 the main application thread is free to process other  
18 tasks in parallel. The event thread also ensures that  
19 the device states persist from one application page to  
20 another: although controls on browser pages are being  
21 continually created and destroyed, the event thread  
22 remains running and ensures that the connection to the  
23 device is never lost.

24

25 When controls are run in a procedural manner, from a  
26 language such as C++, the controls may be set to a mode  
27 in which events are queued up and delivered to the  
28 application on demand, allowing the application to carry  
29 out other tasks, and return to the event queue at an  
30 appropriate time.

31

1 The self-service controls provide the functionality  
2 necessary for creating self-service applications.  
3 Important self-service controls are described further  
4 below. The communications controls provide access to the  
5 remote host computers. Both the self-service and  
6 communications controls have the same server architecture  
7 as the device controls and all may be executed  
8 asynchronously.

9  
10 The status monitoring system monitors the health of the  
11 ATM or Kiosk and sends status and alert signals to an  
12 external monitoring station using SNMP alerts.

13  
14 All controls implement a capabilities interface, allowing  
15 an application or wizard to interrogate the capabilities  
16 of the control as well as the device which the control  
17 represents.

18  
19 Therefore, not only can different hardware  
20 implementations be integrated into the same network or  
21 Extranet, the applications can dynamically configure the  
22 services they provide depending on the capabilities of  
23 the hardware available on the kiosk.

24  
25 As a result of this design, individual software  
26 components can be upgraded without having to change other  
27 aspects of the application. New features can be added  
28 without making the application dependent on those  
29 features.

30  
31 Furthermore, hardware and networking components may be  
32 upgraded or altered step by step. Due to the modular



1 nature of the system and its customisability, a plurality  
2 of communications and hardware implementations may be  
3 used at once. This means that an organisation which runs  
4 an ATM/kiosk network might use its legacy communications  
5 and hardware implementations, perhaps concurrently with  
6 Internet/Intranet support. This means that ATM networks  
7 may be implemented and altered step-wise.

8

9 Such upgrades are particularly easy when using the Open  
10 Financial Exchange (OFX) architecture. The middleware  
11 software implements a single OFX Control which may  
12 interface with an OFX server by any networking means.  
13 The OFX server may also interface with a host by any  
14 networking means. Once this architecture is implemented,  
15 the resulting network topology may be readily altered,  
16 making this an easy migration path for existing networks  
17 to use this system.

18

19 A further implication of the design of the controls is  
20 that they can run on an ATM/kiosk even when actual  
21 hardware devices are not present. This allows the  
22 applications to be started up and run, for example for  
23 development and test purposes, without requiring  
24 particular hardware. When the application requests the  
25 capabilities of a particular control, the control will  
26 reply that the device is not present and that the  
27 capabilities are null. Therefore it is possible to  
28 create and test application on, for example, a PC. In  
29 this situation, the PC will behave like an ATM/kiosk in  
30 its interactions with the application.

31

1 An ignore mode is also provided wherein particular  
2 controls will return "success" for every command. This  
3 allows the application to use generic code which does not  
4 need to test whether the device is present at each step,  
5 simplifying the code that needs to be written when  
6 creating an application to cope with various hardware  
7 capabilities.

8  
9 An HTML-based application is also provided with the  
10 system for testing device controls. This application  
11 allows the operator to select a subset of the devices for  
12 testing. For each device, two test sequences are  
13 defined: one requires operator interaction (e.g.  
14 entering/removing a card) and one requires no operator  
15 interaction. When the latter is selected, the  
16 interaction-free test sequences will be repetitively run  
17 for the selected devices, allowing applications provided  
18 using this system to be easily stress tested. Complete  
19 tests including operator interaction may also be  
20 selected. Testing is automated and therefore as  
21 reproducible as possible.

22  
23 All controls include a security mechanism. This  
24 mechanism allows the methods of the various controls to  
25 be enabled and disabled. This is particularly important  
26 in an Extranet environment when applications of differing  
27 abilities run on a given kiosk or ATM. For example, if a  
28 bank operating a network of ATMs allowed an airline to  
29 dispense tickets through its ATMs by way of an Extranet,  
30 it would wish to disallow the airline's application from  
31 dispensing cash.

32

1 This security mechanism is implemented by a key passing  
2 technique as follows:

3  
4 The middleware software contains a security control which  
5 allows the current security configuration of an ATM or  
6 kiosk to be set. Using the security control, the owner  
7 of the ATM or kiosk can specify details of the security  
8 configuration (i.e. which methods of a control are  
9 allowed and disallowed). Applications identify  
10 themselves to the security control via a digital  
11 certificate which sets the security configuration as  
12 specified by the ATM/kiosk owner. If the application  
13 attempts to call a disallowed method of control, a trap  
14 is generated, transferring control to the ATM/kiosk  
15 owner's application.

16  
17 An important benefit of the system is that it may readily  
18 be used to provide internet based e-commerce facilities  
19 through ATMs and kiosks, not only allowing e-commerce  
20 facilities to be used by a larger consumer base but also  
21 enabling e-commerce which requires expensive or high-  
22 security hardware facilities such as cash dispensers or  
23 identity verification means that cannot readily be  
24 provided on privately owned PCs and web-browsers.

25  
26 To help enable this, the system provides a Site-Minder  
27 control which allows existing web sites to be safely  
28 delivered via ATMs and kiosks. This control provides  
29 several important features. For example, it monitors the  
30 URL of each page of the web-site being delivered and  
31 allows or disallows the page according to a rules  
32 database. This stops the user from straying into other

1 web-sites or web-pages that are not normally part of the  
2 purpose of the ATM/kiosk. The control allows each page  
3 to be given a customised time-out which is important as  
4 web sites are normally designed for use at home and have  
5 different (longer) time-outs than would be appropriate  
6 for public ATMs/kiosks. Web pages may be navigated using  
7 a touch sensitive screen, making them intuitive and easy  
8 to use. The control can also magnify small features on a  
9 web page (such as hypertext links and images with links)  
10 This magnification can be toggled on and off by the user,  
11 thereby animating the hypertext link. This is beneficial  
12 firstly because it makes it easier for the user to see  
13 where the link is and secondly because it becomes easier  
14 for the user to select the link when it is in its  
15 magnified state.

16

17 An additional feature provided by the system for use with  
18 ATMs/kiosks with touchscreens is a "softkeyboard" wherein  
19 a keyboard is displayed on the touch screen and contact  
20 with the displayed keyboard is interpreted by the system  
21 like keystrokes on a real keyboard, thereby removing the  
22 need for a physical keyboard to be provided.

23

24 One problem commonly faced by web designers is that  
25 objects placed on a web page are destroyed when the page  
26 is changed. A useful benefit of the middleware is that  
27 the ActiveX\* hook idea solves this problem - underlying  
28 objects remain persistent while lightweight hooks on each  
29 page access the object.

30

31 Lack of persistence also leads to problems for the  
32 application developer in storing application-wide data.

1 A solution to this problem is provided by a scratchpad  
2 control which has a persistent object at its core and  
3 allows the application to store and retrieve data at any  
4 time. This control supports the Vbscript variant type,  
5 allowing all types of data to be stored and retrieved.  
6 Furthermore, this control allows data to be shared  
7 between multiple applications, marking it as shared.  
8  
9 A related problem when implementing web-based ATM  
10 applications relates to events which must be dealt with  
11 immediately, no matter when the event occurs. For  
12 instance, if a safe door is opened, an application may  
13 need to shut down immediately. This would not be easy to  
14 implement in a web-based environment as every page would  
15 have to contain some code to handle the event. This  
16 problem can be solved in the system by operating a  
17 second, invisible frame alongside the main application  
18 frame. The invisible frame contains all the device  
19 controls needed to detect the events that must be reacted  
20 to. This frame may then take control, perhaps closing  
21 down the main frame.  
22  
23 Error handling in traditional ATM applications is  
24 difficult. Components may return a large number of error  
25 cases, resulting in complex code.  
26  
27 The middleware software separates the responses it sends  
28 to the application into "good responses" and error  
29 responses. Most commands have a single good response and  
30 all errors are mapped to a single error response,  
31 although some may have a plurality of good responses.  
32 Good responses allow the application to continue. When

1 an error response is returned, the current transaction  
2 flow is normally aborted and control flow jumps out of  
3 the normal flow process to handle the error situation.  
4 The application can then interrogate the control to  
5 determine the exact cause of the error.

6

7 A benefit of this approach is that normal flow is not  
8 cluttered by handlers for each of the error cases which  
9 can occur. Control may be transferred to generic error  
10 handlers which can either recover from the error or abort  
11 the transaction completely, perhaps even rebooting the  
12 ATM/kiosk. Application code can therefore remain as  
13 clear and concise as possible whilst encouraging the  
14 application developer to handle all error cases by  
15 calling an error handler. In the development  
16 environment, fatal errors result in a message box being  
17 displayed. A single type of event, DeviceError, is  
18 generated when there is some kind of hardware failure,  
19 allowing error handling for hardware failure to be  
20 encapsulated rather than scattered over many error  
21 handlers.

22

23 The system requires applications to interact with it in a  
24 well defined way. Even small transgressions are detected  
25 and error responses generated; when this happens, the  
26 current environment is abandoned and the application is  
27 terminated.

28

29 This is based on the well known software engineering  
30 approach of assertion; however, the system's assertion  
31 differs from common practice by asserting absolutely all  
32 disallowed cases, whether serious or not. As a result of

1 this strategy of escalating errors to maximum  
2 seriousness, errors are found earlier at development time  
3 or at system test time and never allowed to reach a live  
4 environment. Although there is a risk of the application  
5 reporting a fatal error in the field for a relatively  
6 minor problem, this strategy achieves a particularly high  
7 level of robustness in comparison to prior art software  
8 applications.

9  
10 An additional error-handling feature is provided by the  
11 way in which the system deals with tracing. In software  
12 engineering, tracing is typically enabled only when a  
13 problem is suspected; however, this can affect the  
14 dynamics of a program, making it harder to find bugs.  
15 This is a particularly substantial problem when dealing  
16 with time-critical ATM/kiosk applications. However, if  
17 conventional tracing was simply always enabled throughout  
18 both development and operation of the ATM/kiosk, there  
19 would be both performance problems due to, for example,  
20 the time spent writing to a hard drive and large quantity  
21 of disk space required to store the large number of trace  
22 events that will typically be produced.

23  
24 The middleware software provides a trace control which  
25 records all trace events of the application and  
26 underlying middleware and is always enabled. Performance  
27 problems are dealt with by writing trace data to memory  
28 and writing to disk only when the ATM/kiosk is idle.  
29 Cash-dispensing machines and kiosks go through an idle  
30 cycle between two users which provides sufficient time to  
31 write to disk, even when people are queuing at the  
32 machine. Disk space problems are eliminated by using a

1 ring buffer of fixed file size, allocated at boot-up and  
2 constant in size throughout operation. When the buffer  
3 is full, the oldest data is overwritten, thereby leaving  
4 a continual record of the most recent events.

5

6 As a result of this tracing strategy it is much easier to  
7 understand one-off or rare problems, which is not easily  
8 done when tracing is enabled only once a problem has been  
9 reported.

10

11 Furthermore, some ATM/kiosk vendors provide a limited  
12 amount of non-volatile RAM. When this is provided, the  
13 trace control writes the most recent trace information to  
14 this RAM in a ring buffer fashion. As this is very  
15 quick, it does not produce any performance problems.  
16 However, if the ATM/kiosk freezes up or crashes, the RAM  
17 contains the trace of what happened immediately before.

18

19 In addition to the traditional way that ActiveX<sup>®</sup> fires  
20 events to the container, the device and self-service  
21 controls are able to queue up events and return them one  
22 by one when requested. This allows C++ applications to  
23 be written in a procedural fashion rather than simply in  
24 an event driven fashion. By queuing up these events and  
25 delivering them to the application only on demand, the  
26 system allows procedural code to be written and makes it  
27 easier to develop and maintain the complex logic required  
28 in self-service applications.

29

30 Important self-service controls are described below:

31



- 1 • Watchdog control: runs in a separate Windows NT<sup>\*</sup>  
2 process and reboots the ATM/kiosk if the application  
3 crashes. This is achieved by regularly polling the  
4 application to check that it is functioning correctly.  
5 This control can also be used to daily reboot the  
6 ATM/kiosk. The watchdog can monitor multiple  
7 applications on a single ATM.
- 8 • System Escape control: used to reboot the ATM/kiosk.  
9 Exits in a customisable manner. This control ensures  
10 that cached data (eg in the DataCollect control and the  
11 Trace control) is flushed to disk before rebooting.
- 12 • DataCollect control: allows application to collect raw  
13 data for statistical purposes. It logs and timestamps  
14 the various events. As with the Trace control, it logs  
15 to memory and then stores on hard disk only when the  
16 ATM/kiosk is idle due to the time required to write to  
17 the hard disk. Storage by this control is of a fixed  
18 size allocated at start-up and remaining constant  
19 throughout operation. Storage is in the form of a ring  
20 buffer. Typically, the collected data would be  
21 exported to a remote location for analysis.
- 22 • Trace control: described above.
- 23 • Scratchpad control: described above.
- 24 • Supervisor application: run simultaneously as a  
25 separate application. This means that on an ATM/kiosk  
26 with a rear screen, the operator can interact with the  
27 ATM/kiosk without taking the machine offline. It  
28 allows the operator to access statistics etc. while the  
29 machine is still being used. Alternatively, the  
30 machine may be taken off-line for intrusive  
31 maintenance. In this case, the supervisor application

- 1 provides an off-line mode with a limited subset of the  
2 on-line features.
- 3 • Security control: described above.
  - 4 • Registry control: allows Windows NT<sup>®</sup> registry to be  
5 manipulated by the application.
  - 6 • DirectoryTree control.
  - 7 • Application Launcher control.
  - 8 • INI file control: allows Windows<sup>®</sup> INI files to be read  
9 from the browser.
  - 10 • Timed FTP. This allows statistics files and trace files  
11 to be sent via the FTP mechanism on a timed basis to an  
12 offsite location. (eg daily or weekly).
  - 13 • Key capture control: allows special Windows<sup>®</sup> key  
14 combinations such as ctrl-alt-del and alt-tab to be  
15 captured where a full PC keyboard is provided.
  - 16 • Popup suppression control. Monitors and captures popup  
17 windows originating from the operating system. This  
18 makes it easier to allow software components from other  
19 vendors to be used in self-service applications. Most  
20 third-party software is not intended for self-service  
21 applications and expects to be able to interact with  
22 the user through popup windows. This is unacceptable  
23 in a self-service environment where the main  
24 application must have a complete monopoly over the user  
25 dialog. This control alleviates this problem by  
26 monitoring popups and rapidly executing a pre-  
27 determined sequence of tasks, for example hiding the  
28 popup and pressing the OK button.
  - 29 • Global config file control. Allows configuration data  
30 for ATM networks to be centrally held in a single  
31 distributable file. Each ATM/kiosk can query this

1 control to retrieve the configuration data which is  
2 specific for that ATM/kiosk. This allows variation  
3 between individual ATMs/kiosks to be handled in a  
4 global way.

5 • Telephony control. Allows modems and telephone handsets  
6 to be integrated.

7 • SSMS control. Allows software to be downloaded and  
8 installed in a controlled manner. This control checks  
9 for installation failures and allows the system to  
10 recover to a well defined state.

11 • Screensaver control. This control allows the  
12 application to jump to a defined web page if the user  
13 has been inactive for more than a pre-determined time.

14 • Multiple language control. This control allows the  
15 language on a web page to be dynamically modified. It  
16 does this by retrieving text strings and graphics from  
17 a database on the kiosk. This means that the user may  
18 change languages from any browser page - and therefore  
19 at any stage of the application.

20 • Clock synch control. This allows the application to  
21 synchronize its clock with a server clock, taking into  
22 account possible differences in timezone between kiosk  
23 and server and taking into account the possibility of  
24 large timelags for communication between the kiosk and  
25 the server.

26 Use of the self-service controls plus additional features  
27 of the system and underlying operating system allow  
28 ATMs/kiosks to be managed from a remote location. For  
29 example, the system supports:

30 • Daily software downloads from a remote web server.  
31 • Daily reboot and system check.

- 1 • Daily FTP of statistics data to a remote monitoring  
2 station.
- 3 • Daily FTP of trace data to a remote monitoring system.
- 4 • Regular health checks of the kiosk (typically every 5  
5 minutes).
- 6 • Sending a regular "heartbeat" message to a remote  
7 monitoring station. Monitoring of this message allows  
8 the fact that the device is continually functioning to  
9 be monitored.
- 10 • Allowing direct secure access to the kiosk over a  
11 network, for example the Internet, from a remote  
12 location.
- 13 • Allowing software maintenance over a network, for  
14 example the Internet, from a remote location.
- 15 • Allowing manual reboot of the kiosk over a network, for  
16 example the Internet, from a remote location.

17

18 Although hardware is accessed via the WOSA XFS standard,  
19 which assigns a different number to each command, the  
20 controls have differently named methods and events  
21 associated with each operation, making application  
22 development easier. WOSA commands may typically generate  
23 30-50 events. This wastes time for the application  
24 developer and increases the possibilities of error. The  
25 middleware reduces the set of possible outcomes to a  
26 small number of clearly named completion events, making  
27 it easier for the application developer to write reliable  
28 code quickly. Outcomes which can only happen if there is  
29 a bug in the application cause fatal errors to be  
30 triggered.

31

1 The system automatically opens a WOSA XFS session when a  
2 device control is first used; there is therefore no need  
3 to manually call an Open method. WOSA sessions are  
4 maintained between pages through the use of event  
5 threads, described above.

6  
7 All WOSA XFS methods require a timeout to be provided;  
8 however, this is not appropriate or meaningful for the  
9 majority of commands in this application. The middleware  
10 requires a timeout to be supplied only where it is  
11 meaningful to do so. WOSA also allows cancel commands to  
12 be sent after any other command. Not all ATM functions  
13 can really be cancelled and the middleware only provides  
14 cancel commands where cancellation can actually be  
15 achieved. The request IDs returned by WOSA for each  
16 asynchronous operation are abstracted out by the  
17 middleware. WOSA is accessed only by the middleware and  
18 not directly by the application.

19  
20 Clearly the preferred embodiment described above may  
21 readily be adapted to operate with any operating system  
22 or component system.

23  
24 Further modifications and improvements may be  
25 incorporated without departing from the scope of the  
26 invention herein intended.

1   CLAIMS

2

3   1.   A method for providing transaction services wherein

4

5       (a)   the user of the transaction services interacts  
6       with a computer-based transaction machine which is  
7       controlled by one or more software applications;

8

9       (b)   the software applications interact with the  
10       functional interfaces of middleware software, which  
11       extends the functionality of an underlying operating  
12       system; and

13

14       (c)   said functional interfaces provide functionality  
15       which is implemented in a manner adapted to the  
16       particular hardware capabilities of the transaction  
17       machine.

18

19   2.   A method for providing transaction services  
20       according to Claim 1 wherein the transaction machine  
21       is selected from a group which comprises automatic  
22       teller machines, kiosks and electronic point of sale  
23       machines.

24

25   3.   A method for providing transaction services  
26       according to any preceding Claim wherein middleware  
27       software comprises a series of transaction objects  
28       and controls for standard device functions.

29

30   4.   A method for providing transaction services  
31       according to Claim 3 wherein transaction objects are  
32       independent of the interface between the user and

- 1       the transaction machine; the interface between the  
2       user and the transaction machine being customisable.  
3
- 4   5.   A method for providing transaction services  
5       according to Claim 3 or Claim 4 wherein controls  
6       implement a capabilities interface.  
7
- 8   6.   A method for providing transaction services  
9       according to Claim 5 wherein the capabilities  
10      interface can communicate the capabilities of the  
11      control software.  
12
- 13   7.   A method for providing transaction services  
14      according to any of Claims 3 to 6 wherein  
15      applications, objects and controls are concurrent  
16      and asynchronous.  
17
- 18   8.   A method for providing transaction services  
19      according to any of Claims 3 to 7 wherein controls  
20      have a mode in which events are queued up and  
21      delivered to the application on demand.  
22
- 23   9.   A method for providing transaction services  
24      according to any of Claims 3 to 8 wherein controls  
25      are adapted to run on the transaction machine even  
26      when supported hardware devices are not present.  
27
- 28   10.   A method for providing transaction services  
29      according to any preceding Claim wherein the  
30      middleware software uses one or more open standards  
31      for interacting with different hardware systems.  
32

- 1 11. A method for providing transaction services  
2 according to any preceding Claims wherein middleware  
3 software only provides cancellation commands for  
4 functions which can be successfully cancelled.  
5
- 6 12. A method for providing transaction services  
7 according to any preceding Claim wherein middleware  
8 software only requires a timeout command to be  
9 supplied when it is meaningful to do so.  
10
- 11 13. A method for providing transaction services  
12 according to any of Claims 3 to 12 wherein all  
13 controls are persistent.  
14
- 15 14. A method for providing transaction services  
16 according to any of Claims 3 to 13 wherein there is  
17 provided a control containing a persistent object.  
18
- 19 15. A method for providing transaction services  
20 according to any preceding Claim wherein all errors  
21 and transgressions are asserted by the middleware  
22 software.  
23
- 24 16. A method for providing transaction services  
25 according to any preceding Claim in which the  
26 middleware software provides a trace facility that  
27 is always enabled and which logs trace events.  
28
- 29 17. A method for providing transaction services  
30 according to Claim 16 wherein the middleware  
31 software uses a ring buffer to store a log of trace  
32 events.



1

2 18. A method for providing transaction services  
3 according to Claim 17 wherein the middleware  
4 software writes trace data to memory and then copies  
5 it to disk only when the transaction machine is  
6 idle.

7

8 19. A method for providing transaction services  
9 according to any preceding Claim wherein one or more  
10 software applications are hosted in a web browser.

11

12 20. A method for providing transaction services  
13 according to Claim 19 wherein the use of a web  
14 browser provides support for software distribution  
15 and network connections.

16

17 21. A method for providing transaction services  
18 according to Claim 19 or Claim 20 wherein an  
19 additional browser frame is provided which contains  
20 the device controls required to detect events which  
21 must be dealt with immediately they occur.

22

23 22. A method for providing transaction services  
24 according to any preceding Claim wherein middleware  
25 software comprises a series of COM components with a  
26 scriptable ActiveX<sup>®</sup> interface.

27

28 23. A method for providing transaction services  
29 according to any preceding Claim wherein middleware  
30 software comprises a series of Javabeans<sup>™</sup> components  
31 with a scriptable interface.

32

- 1 24. A method for providing transaction services  
2 according to any of Claims 19 to 23 wherein use of a  
3 web browser allows conventional web sites to be  
4 displayed by the computer-based transaction machine.  
5
- 6 25. A method for providing transaction services  
7 according to Claim 24 wherein middleware software  
8 allows or disallows access to particular web sites  
9 according to a rule database.  
10
- 11 26. A method for providing transaction services  
12 according to Claim 24 or Claim 25 wherein middleware  
13 software is adapted to customise time-out of the  
14 display of individual internet web sites.  
15
- 16 27. A method for providing transaction services  
17 according to any preceding Claim wherein the  
18 computer-based transaction machine is adapted to  
19 allow the software applications and middleware to be  
20 altered across a network by an authority.  
21
- 22 28. A method for providing transaction services  
23 according to any preceding Claim wherein the  
24 transaction machine can communicate information  
25 about their status to a remote monitoring station  
26 across a network.  
27
- 28 29. A computer-based transaction machine; wherein said  
29 computer-based transaction machine is provided with  
30 hardware devices for interaction with users and the  
31 exchange of transaction-related information with  
32 other machines; wherein said computer-based

- 1 transaction machine is controlled by one or more  
2 software applications; wherein said software  
3 applications control hardware devices through  
4 functional interfaces with middleware software;  
5 wherein said middleware software extends the  
6 functionality of an underlying operating system and  
7 wherein said functional interfaces are hardware  
8 independent but provide functionality which is  
9 implemented in a manner adapted to the capabilities  
10 of the particular hardware devices which are  
11 provided.  
12
- 13 30. A computer-based transaction machine according to  
14 Claim 29 wherein the transaction machine is selected  
15 from a group which comprises automatic teller  
16 machines, kiosks and electronic point of sale  
17 machines.  
18
- 19 31. A computer-based transaction machine according to  
20 Claim 29 or Claim 30 wherein middleware software  
21 comprises a series of transaction objects and  
22 controls for standard device functions.  
23
- 24 32. A computer-based transaction machine according to  
25 Claim 31 wherein transaction objects are independent  
26 of the interface between the user and the  
27 transaction machine; the interface between the user  
28 and the transaction machine being customisable.  
29
- 30 33. A computer-based transaction machine according to  
31 Claim 31 or Claim 32 wherein controls implement a  
32 capabilities interface.

1

2 34. A computer-based transaction machine according to  
3 Claim 33 wherein the capabilities interface can  
4 communicate the capabilities of the control  
5 software.

6

7 35. A computer-based transaction machine according to  
8 any of Claims 31 to 34 wherein applications, objects  
9 and controls are concurrent and asynchronous.

10

11 36. A computer-based transaction machine according to  
12 any of Claims 31 to 35 wherein controls have a mode  
13 in which events are queued up and delivered to the  
14 application on demand.

15

16 37. A computer-based transaction machine according to  
17 any of Claims 31 to 36 wherein controls are adapted  
18 to run on the transaction machine even when  
19 supported hardware devices are not present.

20

21 38. A computer-based transaction machine according to  
22 any of Claims 29 to 37 wherein the middleware  
23 software uses one or more open standards for  
24 interacting with different hardware systems.

25

26 39. A computer-based transaction machine according to  
27 any of Claims 29 to 38 wherein middleware software  
28 only provides cancellation commands for functions  
29 which can be successfully cancelled.

30

31 40. A computer-based transaction machine according to  
32 any of Claims 29 to 39 wherein middleware software

- 1       only requires a timeout command to be supplied when  
2       it is meaningful to do so.  
3
- 4   41.   A computer-based transaction machine according to  
5       any of Claims 31 to 40 wherein all controls are  
6       persistent.  
7
- 8   42.   A computer-based transaction machine according to  
9       any of Claims 31 to 41 wherein there is provided a  
10      control containing a persistent object.  
11
- 12   43.   A computer-based transaction machine according to  
13      any of Claims 29 to 42 wherein all errors and  
14      transgressions are asserted by the middleware  
15      software.  
16
- 17   44.   A computer-based transaction machine according to  
18      any of Claims 29 to 43 wherein the middleware  
19      software provides a trace facility that is always  
20      enabled and which logs trace events.  
21
- 22   45.   A computer-based transaction machine according to  
23      Claim 44 wherein the middleware software uses a ring  
24      buffer to store a log of trace events.  
25
- 26   46.   A computer-based transaction machine according to  
27      Claim 45 wherein the middleware software writes  
28      trace data to memory and then copies it to disk only  
29      when the transaction machine is idle.  
30

- 1 47. A computer-based transaction machine according to  
2 any of Claims 29 to 46 wherein one or more software  
3 applications are hosted in a web browser.  
4
- 5 48. A computer-based transaction machine according to  
6 Claim 47 wherein the use of a web browser provides  
7 support for software distribution and network  
8 connections.  
9
- 10 49. A computer-based transaction machine according to  
11 Claim 47 or Claim 48 wherein an additional browser  
12 frame is provided which contains the device controls  
13 required to detect events which must be dealt with  
14 immediately they occur.  
15
- 16 50. A computer-based transaction machine according to  
17 any of Claims 29 to 49 wherein middleware software  
18 comprises a series of COM components with a  
19 scriptable ActiveX\* interface.  
20
- 21 51. A computer-based transaction machine according to  
22 any of Claims 29 to 50 wherein middleware software  
23 comprises a series of Javabeans™ components with a  
24 scriptable interface.  
25
- 26 52. A computer-based transaction machine according to  
27 any of Claims 47 to 51 wherein use of a web browser  
28 allows conventional web sites to be displayed by the  
29 computer-based transaction machine.  
30
- 31 53. A computer-based transaction machine according to  
32 Claim 52 wherein middleware software allows or

1       disallows access to particular web sites according  
2       to a rule database.

3

4   54. A computer-based transaction machine according to  
5       Claim 52 or Claim 53 wherein middleware software is  
6       adapted to customise time-out of the display of  
7       individual internet web sites.

8

9   55. A computer-based transaction machine according to  
10      any of Claims 29 to 54 wherein the computer-based  
11      transaction machine is adapted to allow the software  
12      applications and middleware to be altered across a  
13      network by an authority.

14

15   56. A computer-based transaction machine according to  
16      any of Claims 29 to 55 wherein the transaction  
17      machine can communicate information about their  
18      status to a remote monitoring station across a  
19      network.

20

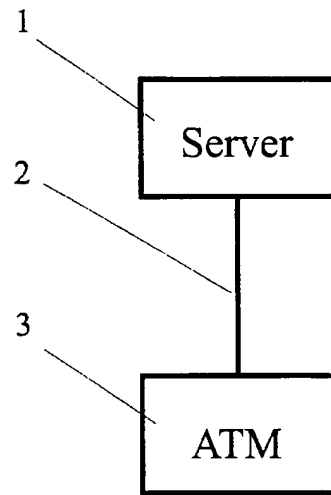
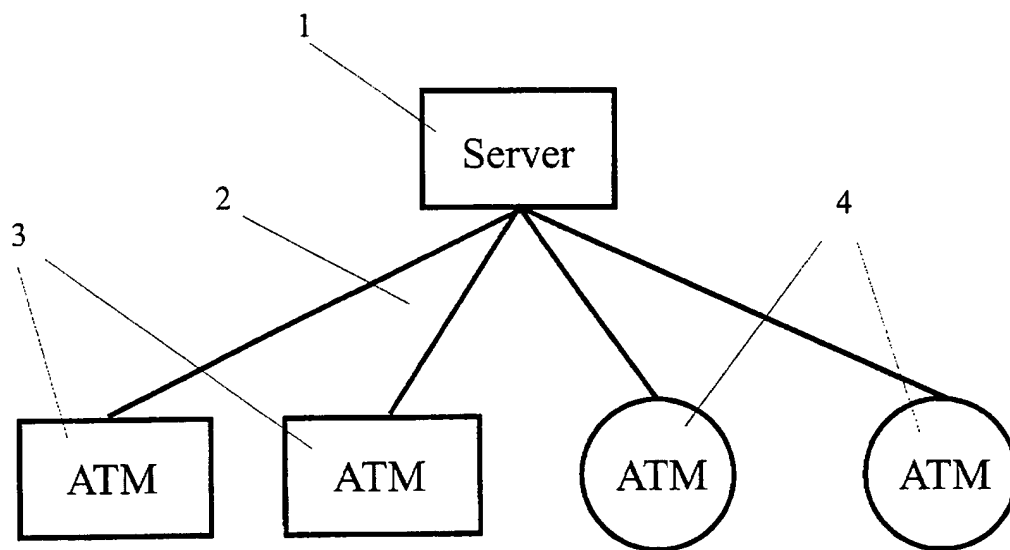
21   57. A network comprising a plurality of computer-based  
22      transaction machines according to any of Claims 29  
23      to 56, one or more networking means and one or more  
24      application servers.

25

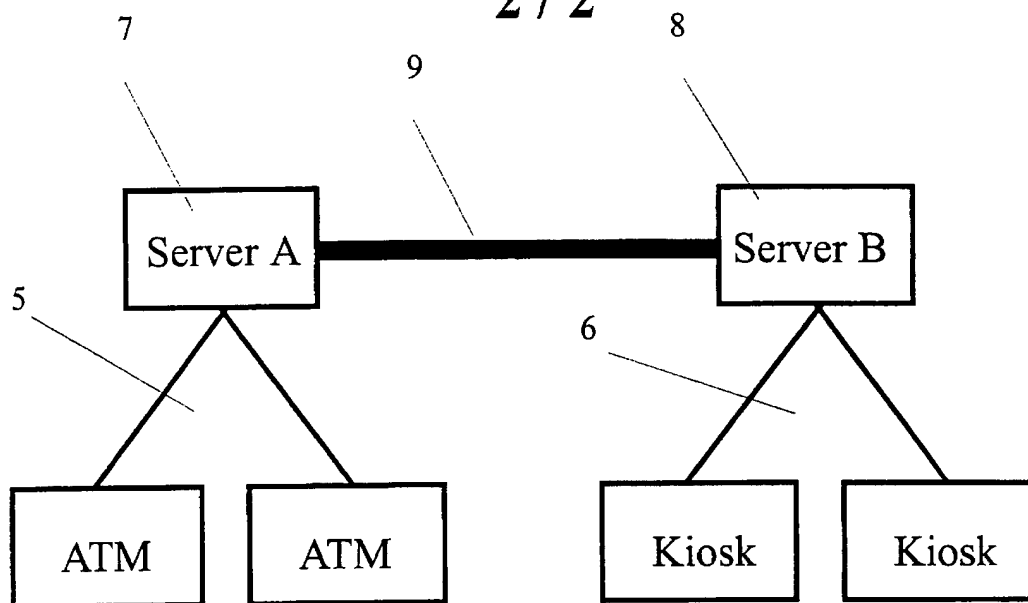
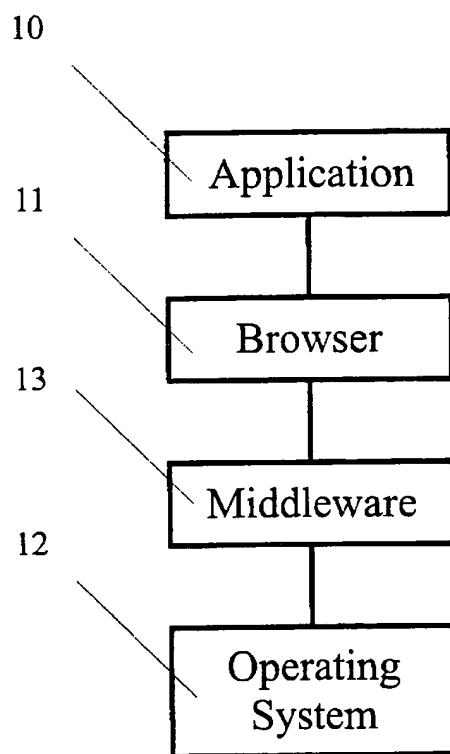
26   58. An Extranet formed by combining a plurality of  
27      networks of computer-based transaction machines  
28      according to Claim 57.

- 1 59. An Extranet according to Claim 58 provided with a
- 2 security mechanism which limits the hardware
- 3 functionality available to individual software
- 4 applications.



**1 / 2****Figure 1****Figure 2**

2 / 2

**Figure 3****Figure 4**

# INTERNATIONAL SEARCH REPORT

Intern Application No  
PCT/GB 99/00927

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 G07F19/00 G06F17/60 G07F7/10

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 G07F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 45796 A (BARCELOU) 4 December 1997 (1997-12-04)  page 2, line 6 - line 18 page 6, line 22 -page 7, line 6 page 7, line 24 -page 8, line 5; figures ---	1,2,19, 24, 29, 30,47,52
A	WO 97 10562 A (CYBERMARK, L.L.C.) 20 March 1997 (1997-03-20) page 6, line 2 - line 4 page 7, line 11 - line 18; figures 1,2,4 ---	1,2,29, 30
A	WO 97 05582 A (KEYCORP LIMITED) 13 February 1997 (1997-02-13) page 5, last paragraph -page 6, line 8 page 7, line 22 -page 9, line 9; figures 5,6,8,11 --- -/--	1,29

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

4 October 1999

Date of mailing of the international search report

12/10/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Neville, D

# INTERNATIONAL SEARCH REPORT

Interns Application No  
PCT/GB 99/00927

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 5 710 887 A (CHELLIAH ET AL.) 20 January 1998 (1998-01-20) column 8, line 51 - line 64 ---	1,29
A	WO 97 41541 A (VERIFONE) 6 November 1997 (1997-11-06)  page 23, last paragraph -page 24, line 17 -----	1,3,22, 23,29, 31,50, 51,57,58

1

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International Application No

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